TITLE

APPARATUS FOR CONTROLLING LOAD BALANCE OF MULTI-ACCESS POINTS IN WIRELESS LAN SYSTEM AND METHOD THEREOF

CLAIM OF PRIORITY

[0001]   This application makes reference to, incorporates the same herein, and claims all benefits accruing under 35 U.S.C. §119 from an application for *APPARATUS FOR CONTROLLING THE LOAD BALANCE IN MULTI-ACCESS POINTS AND METHOD THEREOF* earlier filed in the Korean Intellectual Property Office on 2 December 2002 and there duly assigned Serial No. 2002-76052.

BACKGROUND OF THE INVENTION

Field of the Invention

[0002]   The present invention generally relates to in multi-access points of a wireless LAN (Local Area Network) system, and more specifically to an apparatus for controlling load balance of multi-access points in a wireless LAN system and a method thereof for preventing load from being concentrated on a specific access point by comparatively evaluating load values of many access points after receiving the load values of the access points, and rejecting terminal access or removing existing accessed terminals in an access point where load is concentrated.

Description of the Related Art

[0003] Generally, widely-used information terminals such as PCs (Personal Computers) or notebooks, PDAs (Personal Digital Assistants) configure a network named LAN (Local Area Network) to reciprocally share information. The LAN is divided into a wired LAN configured by directly connecting the information terminals with the use of communication cables and a wireless LAN configured in wireless communication way using access points.

[0004] The wireless LAN is free to move by transceiving data in the wireless communication way with the use of RF (Radio Frequency) or light, as well as easy to expand and maintain. In addition, it supplies a 10/100 BASE-T Ethernet interface function of IEEE (Institute of Electrical and Electronics Engineers) 802.3 as a wired processor, and secures a 2Mbps (megabits per second) transmission rate in a 2.4GHz (gigahertz) frequency band of IEEE 802.11 as a wireless processor.

[0005] A wireless LAN system configures a network including: a wireless LAN terminal, an information terminal used by a wireless LAN user; a router and a hub for Internet access; an authenticating server providing an Internet access service; and an access point located between the wireless LAN terminal and the hub relays wireless LAN communication of the corresponding wireless LAN terminal by transmitting an Internet access request to the authenticating server.

[0006] Here, the access point is a wireless LAN access equipment supporting interworking between an existing wired LAN service area and a wireless LAN service area, and includes more than one Ethernet MAC (Media Access Control) and wireless LAN MAC. According to a definition of the wireless LAN MAC in the IEEE 802.11, the access point passes through authentication and association processes in order to manage a self wireless LAN service area.

1   **[0007]** In other words, while requesting Internet access of the wireless LAN terminal, the existing

2   access point performs a wireless LAN relaying function to access the Internet by requesting access

3   authentication of the authenticating server after receiving Internet access information, that is, IP

4   (Internet protocol), gateway, and DNS (Domain Name Server) information preset in the wireless

5   LAN terminal from the corresponding wireless LAN terminal.

6   **[0008]** At this time, the wireless LAN terminal is authenticated from the authenticating server to

7   access the Internet by inputting a self registered member ID (Identifier) and a password. If the

8   authenticating server permits the Internet access, the corresponding wireless LAN terminal

9   configures a wireless network by having access to the Internet through the access point, the hub, and

10   the router, and transceives data over the Internet. If the authenticating server rejects the Internet

11   access, the Internet access is prohibited.

12   **[0009]** In the meantime, in order to carry out a roaming process (here, this means communication

13   connection switching is performed from one access point to other access point) to another access

14   point from one access point, the wireless LAN terminal executes an operation (scanning) of finding

15   out an access point in which the wireless LAN terminal can register, after transmitting a probe

16   request frame and receiving a probe response frame.

17   **[0010]** Common scans include two types of scans, that is, an active mode scan and a passive mode

18   scan in a default state. First, the active mode scan is performed, and if the access point is not found

19   within a BSS (Basic Service Set), a scanning mode is switched into the passive mode scan to

20   perform the passive mode scan. If the access point is not still found, the active mode scan and the

21   passive mode scan are repeated.

[0011] In the above operation (scanning operation), all channels should be scanned to find out an accessible access point. The roaming process is carried out when the wireless LAN terminal transmits an authentication request frame (requesting the wireless LAN terminal to register in the access point (IEEE802.11)) to an initially-accessed access point based on the scans and receives an authentication response frame authenticating the wireless LAN terminal from the access point.

[0012] However, according to the above roaming system, the wireless LAN terminal is separated from a current access point, scans all accessible access points, and performs a registration procedure in an access point having a maximum RSSI (Receive Signal Structure Indicator).

[0013] Meanwhile, according to an earlier art in which the wireless LAN terminal attempts to access the access point and maintains the access by using an RSSI in a wireless LAN, there is a problem that load is concentrated on several access points while using multi-access points.

[0014] In a wireless LAN environment having multi-access points, the wireless LAN terminals are concentrated on an access point by being located in the access point. On the contrary, there occurs an unequal situation, for instance, an access point does not have any wireless LAN terminals.

[0015] Thus, the wireless LAN terminals of the wireless LAN try to access a near access point. In case the access point permits the access of the terminals, if signal strength of the access point satisfies a threshold value determined in the wireless LAN terminals although load is concentrated on the access point, the wireless LAN terminals continuously maintain data communication through the access point having much load even though other access point is in an idle state. As a result, the wireless LAN operating the multi-access points is inefficiently performed and the access point having the concentrated load causes delay and error problems.

SUMMARY OF THE INVENTION

[0016] It is therefore an object of the present invention to provide an apparatus for controlling load balance of multi-access points in a wireless LAN system and a method thereof for preventing data traffic load from being concentrated in the wireless LAN using the multi-access points.

[0017] In addition, it is another object of the present invention to provide an apparatus for controlling load balance of multi-access points in a wireless LAN system and a method thereof for reducing entire error rates of the wireless LAN by preventing data traffic load from being concentrated on a specific access point in the wireless LAN.

[0018] Also, it is another object of the present invention to provide an apparatus for controlling load balance of multi-access points in a wireless LAN system and a method thereof for satisfying quick processing requests of wireless LAN terminals by preventing data traffic load from being concentrated on a specific access point in the wireless LAN.

[0019] To achieve the above and other objects, there is provided an apparatus for controlling load balance of multi-access points in a wireless LAN system, the apparatus includes: many wireless LAN terminals having wireless LAN interfaces and receiving a wireless LAN service; many access points providing the wireless LAN service to the wireless LAN terminals, periodically transmitting load state information, and suppressing an increase of load when a load suppressing signal is received; and a management system comparatively evaluating load states of each access point by receiving the load state information from the access points, and transmitting a load increase suppressing signal to access points whose load values are more than a threshold value, if there are the access points whose load values are more than the threshold value and other access points around the access points whose

1 load values are more than the threshold value are in idle state.

2 [0020]   On the other hand, to achieve the object, there is provided a method of controlling load

3 balance of multi-access points in a wireless LAN system including many wireless LAN terminals

4 and many access points, the method including: a first step of periodically monitoring load states of

5 the access points; a second step of transmitting a load increase suppressing signal to an access point

6 whose load value exceeds a threshold value, if there is the access point whose load value exceeds

7 the threshold value and there is another idle access point around the access point, while monitoring

8 the load states of the access points; and, a third step of suppressing an increase of load in the

9 corresponding access point according to the transmitted load increase suppressing signal.

BRIEF DESCRIPTION OF THE DRAWINGS

11 [0021]   A more complete appreciation of the invention, and many of the attendant advantages

12 thereof, will be readily apparent as the same becomes better understood by reference to the following

13 detailed description when considered in conjunction with the accompanying drawings in which like

14 reference symbols indicate the same or similar components, wherein:

15 [0022]   Fig. 1 is a diagram illustrating a configuration of a wireless LAN system in accordance

16 with earlier art;

17 [0023]   Fig. 2 is a diagram illustrating a format diagram of a wireless LAN system having

18 multi-access points in accordance with earlier art;

19 [0024]   Fig. 3 is a diagram illustrating an apparatus for controlling load balance of multi-access

20 points in a wireless LAN system in accordance with one embodiment of the present invention;

[0025] Fig. 4 is a diagram illustrating a detailed block configuration of an access points of Fig. 3;

[0026] Fig. 5 is a diagram illustrating a method of controlling load balance of multi-access points in a wireless LAN system in accordance with one embodiment of the present invention as a flow chart; and

[0027] FIG. 6 shows an example of a computer including a computer-readable medium having computer-executable instructions for performing a method of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0028] Fig. 1 is a diagram illustrating a configuration of a wireless LAN system in accordance with earlier art.

[0029] As illustrated in Fig. 1, the wireless LAN system configures a network including: a wireless LAN terminal (11), an information terminal used by a wireless LAN user; a router (12) and a hub (13) for Internet access; an authenticating server (14) providing an Internet access service; and an access point (15) located between the wireless LAN terminal (11) and the hub (13) relays wireless LAN communication of the corresponding wireless LAN terminal (11) by transmitting an Internet access request to the authenticating server (14).

[0030] Here, the access point (15) is a wireless LAN access equipment supporting interworking between an existing wired LAN service area and a wireless LAN service area, and includes more than one Ethernet MAC (Media Access Control) and wireless LAN MAC. According to a definition of the wireless LAN MAC in the IEEE 802.11, the access point (15) passes through authentication

1 and association processes in order to manage a self wireless LAN service area.

2 **[0031]** In other words, while requesting Internet access of the wireless LAN terminal (11), the

3 existing access point (15) performs a wireless LAN relaying function to access the Internet by

4 requesting access authentication of the authenticating server (14) after receiving Internet access

5 information, that is, IP (Internet protocol), gateway, and DNS (Domain Name Server) information

6 preset in the wireless LAN terminal (11) from the corresponding wireless LAN terminal (11).

7 **[0032]** At this time, the wireless LAN terminal (11) is authenticated from the authenticating server

8 (14) to access the Internet by inputting a self registered member ID (Identifier) and a password. If

9 the authenticating server (14) permits the Internet access, the corresponding wireless LAN terminal

10 (11) configures a wireless network by having access to the Internet through the access point (15), the

11 hub (13), and the router (12), and transceives data over the Internet. If the authenticating server(14)

12 rejects the Internet access, the Internet access is prohibited.

13 **[0033]** In the meantime, in order to carry out a roaming process (here, this means communication

14 connection switching is performed from one access point to other access point) to another access

15 point from one access point, the wireless LAN terminal executes an operation (scanning) of finding

16 out an access point in which the wireless LAN terminal can register, after transmitting a probe

17 request frame and receiving a probe response frame.

18 **[0034]** Common scans include two types of scans, that is, an active mode scan and a passive mode

19 scan in a default state. First, the active mode scan is performed, and if the access point is not found ·

20 within a BSS (Basic Service Set), a scanning mode is switched into the passive mode scan to

21 perform the passive mode scan. If the access point is not still found, the active mode scan and the

1   passive mode scan are repeated.

2   **[0035]** In the above operation (scanning operation), all channels should be scanned to find out an

3   accessible access point. The roaming process is carried out when the wireless LAN terminal

4   transmits an authentication request frame (requesting the wireless LAN terminal to register in the

5   access point (IEEE802.11)) to an initially-accessed access point based on the scans and receives an

6   authentication response frame authenticating the wireless LAN terminal (11) from the access point.

7   **[0036]** However, according to the above roaming system, the wireless LAN terminal is separated

8   from a current access point, scans all accessible access points, and performs a registration procedure

9   in an access point having a maximum RSSI (Receive Signal Structure Indicator).

10   **[0037]** Meanwhile, according to an earlier art in which the wireless LAN terminal attempts to

11   access the access point and maintains the access by using an RSSI in a wireless LAN, there is a

12   problem that load is concentrated on several access points while using multi-access points.

13   **[0038]** Fig. 2 is a diagram illustrating a wireless LAN environment having multi-access points in

14   accordance with earlier art.

15   **[0039]** As illustrated in Fig.2, wireless LAN terminals (21a~21c) are concentrated on an access

16   point (25a) by being located in the access point (25a). On the contrary, there occurs an unequal

17   situation, for instance, an access point (25b) does not have any wireless LAN terminals.

18   **[0040]** Thus, the wireless LAN terminals of the wireless LAN try to access a near access point.

19   In case the access point permits the access of the terminals, if signal strength of the access point

20   satisfies a threshold value determined in the wireless LAN terminals although load is concentrated

21   on the access point, the wireless LAN terminals continuously maintain data communication through

1   the access point having much load even though other access point is in an idle state. As a result, the

2   wireless LAN operating the multi-access points is inefficiently performed and the access point

3   having the concentrated load causes delay and error problems.

4   [0041]   The present invention will now be described more fully hereinafter with reference to the

5   accompanying drawings, in which preferred embodiments of the invention are shown. This invention

6   may, however, be embodied in different forms and should not be construed as limited to the

7   embodiments set forth herein. Rather, these embodiments are provided so that this disclosure will

8   be thorough and complete, and will fully convey the scope of the invention to those skilled in the art.

9   In the drawings, the thickness of layers and areas are exaggerated for clarity. It will also be

10   understood that when a layer is referred to as being "on" another layer or substrate, it can be directly

11   on the other layer or substrate or intervention layers may be also be present. Moreover, each

12   embodiment described and illustrated herein includes its complementary conductivity type

13   embodiment as well.

14   [0042]   The following detailed description will present invention apparatus for controlling load

15   balance of multi-access points in wireless LAN system and method thereof according to a preferred

16   embodiment of the invention in reference to the accompanying drawings.

17   [0043]   Fig. 3 is a diagram illustrating an apparatus for controlling load balance of multi-access

18   points in a wireless LAN system in accordance with one embodiment of the present invention.

19   [0044]   As illustrated in Fig.3, a load balance controlling system of the multi-access points in the

20   wireless LAN system includes many wireless LAN terminals (31a~31n), a router (32), a hub (33), .

21   a management system (34), and many access points (35a, 35b, 35c).

[0045]   The management system (34) manages the access points (35a, 35b, 35c), assigns and changes channels for each access point (35a, 35b, 35c), assigns IPs in accordance with DHCP (dynamic host configuration protocol), and monitors operation states of each access point (35a, 35b, 35c).

[0046]   Also, the management system (34) controls the assigned channels of each access point (35a, 35b, 35c) by recognizing present conditions of the wireless LAN terminals (31a~31n) connected to the access points (35a, 35b, 35c).

[0047]   Moreover, the management system (34) performs data path switching by managing information on the access points (35a, 35b, 35c), and stores data on positions of each access point (35a, 35b, 35c).

[0048]   Furthermore, the management system (34) receives the number of the accessed wireless LAN terminals (31a~31n), information and the number of the wireless LAN terminals (31a~31n) recently transmitting data frames after the access, the number of the data frames, and data frame length from the access points (35a, 35b, 35c).

[0049]   Then, the management system (34) comparatively evaluates load states of each access point (35a, 35b, 35c) based on information related to various kinds of load transmitted from each access point (35a, 35b, 35c). If the load of the specific access points (35a, 35b, 35c) exceeds a threshold value, the management system controls not to generate new load in the corresponding access points (35a, 35b, 35c).

[0050]   Such controlling operation can be performed by two functions. One is to transmit an authentication failure response message when the wireless LAN terminals (31a~31n) request a

1   permission to access, without adding the wireless LAN terminals (31a~31n) newly attempting the

2   access to a BSS table.

3   [0051]   On this occasion, the management system (34) can induce the wireless LAN terminals

4   (31a~31n) to access the accessible access points (35a, 35b, 35c) in the idle state by transmitting

5   information on the neighboring accessible access points (35a, 35b, 35c) in idle state.

6   [0052]   Also, the management system (34) makes the wireless LAN terminals attempt to access

7   the access points (35a, 35b, 35c) by transmitting information of the wireless LAN terminals to the

8   neighboring accessible access points (35a, 35b, 35c) in idle state, thereby enabling the wireless LAN

9   terminals attempting to access the access points (35a, 35b, 35c) whose load values exceed the

10 threshold value to access the neighboring access points (35a, 35b, 35c).

11 [0053]   The other controlling function is as follows. When the wireless LAN terminals (31a~31n),

12 which do not continuously generate data traffic though being connected to the access points (35a,

13 35b, 35c), generate data traffic while the load values exceed the threshold value, the BSS table

14 deletes network node addresses of the wireless LAN terminals (31a~31n) generating the new data

15 traffic, so as to stop a data service provided to the wireless LAN terminals (31a~31n).

16 [0054]   At this time, in the same way, the management system (34) can induce the wireless LAN

17 terminals (31a~31n) to access the accessible access points (35a, 35b, 35c) in the idle state by

18 transmitting information on the neighboring accessible access points (35a, 35b, 35c) in the idle state.

19 The management system (34) also makes the wireless LAN terminals access the access points (35a,

20 35b, 35c) by transmitting information on the wireless LAN terminals to the neighboring accessible

21 access points (35a, 35b, 35c) in the idle state, thereby enabling the wireless LAN terminals

1 attempting to access the access points (35a, 35b, 35c) whose load values exceed the threshold value

2 to access the neighboring access points (35a, 35b, 35c).

3 **[0055]** Thus, in order that the management system (34) performs load balancing, it should overall

4 grasp positions of the access points (35a, 35b, 35c), and there should be the access points (35a, 35b,

5 35c) in idle state around the access points (35a, 35b, 35c) whose load values reach the threshold

6 value. If there are no access points (35a, 35b, 35c) in idle state, rather much load will be created

7 while finding out the idle access points (35a, 35b, 35c).

8 **[0056]** On the other hand, the access points (35a, 35b, 35c) are internetworking devices for

9 connecting a wireless LAN to a wired LAN, retransmit overheard wireless LAN network data

10 oriented toward a wired node to the wired LAN, and retransmit wired LAN network data oriented

11 toward the wireless LAN terminals (31a~31n) to the wireless LAN. Here, an internetworking service

12 includes retransmission of a message to a wired LAN node from the wireless LAN terminals

13 (31a~31n), and retransmission of the message to the wireless LAN terminals (31a~31n) from the

14 wired LAN node.

15 **[0057]** The access points (35a, 35b, 35c) may have limited valid ranges according to wireless

16 media, require many devices having overlapping areas to some extent in order to provide a proper

17 coverage area, and cause that messages are repeatedly received by wireless LAN terminals (31c, 31d,

18 31k, 31l, 31m) within the overlapping areas and messages generated from such wireless LAN

19 terminals (31c, 31d, 31k, 31l, 31m) are repeatedly received on the wired LAN.

20 **[0058]** In order that the wireless LAN terminals (31a~31n) are within the access points (35a, 35b,

21 35c), the wireless LAN terminals (31a~31n) should belong to a physical area called a BSA (Basic

1 Service Area) of the access points (35a, 35b, 35c). If the wireless LAN terminals (31a~31n) are

2 within the basic service area of the specific access points (35a, 35b, 35c), the wireless LAN terminals

3 (31a~31n) may receive signals transmitted by the specific access points (35a, 35b, 35c).

4 [0059] Also, the access points (35a, 35b, 35c) physically connected to the wired LAN are

5 connected to power, and transmitters used in the access points (35a, 35b, 35c) may have stronger

6 outputs than battery outputs of transmitters used in the wireless LAN terminals (31a~31n).

7 [0060] The access points (35a, 35b, 35c) transmit self information to each wireless LAN terminal

8 (31a~31n) in beacon type identifying self network addresses at regular intervals, and each wireless

9 LAN terminal (31a~31n) can decide whether to be in a basic service area of which access points

10 (35a, 35b, 35c) by regular data transmissions or beacons of the access points (35a, 35b, 35c).

11 [0061] Each access point (35a, 35b, 35c) maintains tables of all the wireless LAN terminals

12 (31a~31n) connected with the access points, called BSS (Basic Service Set) tables.

13 [0062] After successfully receiving access requests from the wireless LAN terminals (31a~31n),

14 the access points (35a, 35b, 35c) add the network node addresses of the wireless LAN terminals

15 (31a~31n) to the self BSS tables.

16 [0063] When it is displayed that the wireless LAN terminals (31a~31n) previously accessed other

17 access points (35a, 35b, 35c) by the access requests, the access points (35a, 35b, 35c) can enable the

18 previous access points (35a, 35b, 35c) to transmit disassociated data packets through the wired LAN.

19 Unlike this, when the wireless LAN terminals (31a~31n) access the new access points (35a, 35b,

20 35c), the new access points can direct the wireless LAN terminals (31a~31n) to transmit

21 disassociating requests to the previous access points (35a, 35b, 35c).

[0064]   When receiving the disassociated data packets from the new access points (35a, 35b, 35c), the previous access points (35a, 35b, 35c) delete the network node addresses of the wireless LAN terminals (31a~31n) from the previous self BSS tables.

[0065]   In addition, when failing to successfully transmit data to the wireless LAN terminals (31a~31n), the access points (35a, 35b, 35c) consider that self wireless access to the wireless LAN terminals (31a~31n) is cut off, and will delete the wireless LAN terminals (31a~31n) from the self BSS tables.

[0066]   In addition, the access points (35a, 35b, 35c) examine timed data traffic amounts of each wireless LAN terminal (31a~31n) and store them (the timed data traffic amounts of each wireless LAN terminal (31a~31n)), except managing the BSS tables.

[0067]   Furthermore, the access points (35a, 35b, 35c) report the number of the periodically-accessed wireless LAN terminals (31a~31n), the number of the wireless LAN terminals (31a~31n) recently transmitting data frames after the access, the number of the data frames, and data frame length to the management system (34).

[0068]   Also, in case a control signal for stopping an operation of a newly generating load, owing to the load of the management system (34) exceeding a threshold value, is received in response to a report on periodical load states, the access points (35a, 35b, 35c) transmit an authentication failure response message during authentication if the new wireless LAN terminals (31a~31n) access the access points (35a, 35b, 35c), thereby enabling the wireless LAN terminals (31a~31n) to continuously keep having access to the previous access points (35a, 35b, 35c) or to set access with the idle access points (35a, 35b, 35c) located in a mobile direction.

[0069]   If the wireless LAN terminals (31a~31n), which do not continuously generate data traffic and keep accessing according to a control signal of the management system (34), generate new data traffic, the BSS tables delete the corresponding wireless LAN terminals (31a~31n) to stop the access.

[0070]   By doing this, the corresponding access points (35a, 35b, 35c) induce the wireless LAN terminals (31a~31n) to newly find out the neighboring access points (35a, 35b, 35c) in the idle state, and control load balancing of the overall wireless LAN system.

[0071]   Meanwhile, the wireless LAN terminals (31a~31n) receive a wireless LAN service by mounting predetermined wireless LAN cards on information terminals such as notebooks having communication ports like PCMCIA (Personal Computer Memory Card International Association) port and USB (Universal Serial Bus) port or PCI (Peripheral Component Interconnection) slot or EISA (Extended Industry Standard Architecture) slot, PCs, or PDAs.

[0072]   For instance, each wireless LAN card of the wireless LAN terminals (31a~31n) includes: an RF (radio frequency) unit for receiving an RF signal from an antenna for receiving the RF signal, and for transmitting data transmitted to the access points (35a, 35b, 35c) as a high frequency signal, an RF signal; a base band processor for modulating the data transmitted to the access points (35a, 35b, 35c) by the RF unit; and an MAC processor performing a data link through an MAC (Medium (or Media) Access Protocol). The RF unit includes: an amplifier for amplifying the RF signal; an RF/IF (radio frequency to intermediate frequency) converter coupled with an oscillator and performing signal conversion between the RF signal and an IF signal; and an IF/BB (intermediate frequency to base band) converter connected between the RF/IF converter and the base band processor, and performing signal conversion between the IF signal and a BB (Base Band) signal.

[0073]   The wireless LAN terminals (31a~31n) receiving the wireless LAN service request to have access to the access points (35a, 35b, 35c) by transmitting a wireless signal including kinds of security functions showing self encoding methods according to wireless LAN standards such as IEEE 802.11.

[0074]   The wireless LAN terminals (31a~31n) track the overheard access points (35a, 35b, 35c), and maintain/manage information on the recently overheard access points (35a, 35b, 35c) in access point tables.

[0075]   When overhearing data packets from the access points (35a, 35b, 35c), the wireless LAN terminals (31a~31n) can attempt access to the access points (35a, 35b, 35c) by transmitting access requests to the access points (35a, 35b, 35c).

[0076]   If failing to transmit the access requests to the specific access points (35a, 35b, 35c), the wireless LAN terminals (31a~31n) attempt access to other access points existing in the access tables.

[0077]   If the wireless LAN terminals (31a~31n) overhear more than two access points (35a, 35b, 35c) or there are more than two access points (35a, 35b, 35c) in the tables, the wireless LAN terminals (31a~31f) should select one of the access points (35a, 35b, 35c).

[0078]   Moreover, in case the access to the access points (35a, 35b, 35c) is stopped, the wireless LAN terminals (31a~31n) attempt access to the most recently overheard access points (35a, 35b, 35c) in the access point tables.

[0079]   In the meantime, when the wireless LAN terminals failing to attempt the access receive information on the neighboring idle access points (35a, 35b, 35c) from the access points (35a, 35b, 35c), they can have access to the idle access points (35a, 35b, 35c) by attempting access to the idle

1 access points (35a, 35b, 35c) based on the received information.

2 **[0080]** In addition, when receiving access request signals received from the idle access points

3 (35a, 35b, 35c), the wireless LAN terminals can have access to the idle access points (35a, 35b, 35c)

4 by transmitting access response signals.

5 **[0081]** Hereinafter, an operation of a load balance controlling system applied to the present

6 invention will be more fully described as follows in reference to Fig. 3.

7 **[0082]** Many access points (35a, 35b, 35c) keep accessing to many wireless LAN terminals

8 (31a~31n), and the access point (35a) located in the highest position keeps accessing to 4 terminals

9 (31a~31d). The access point (35b) located in the middle keeps accessing to 9 wireless LAN terminals

10 (31e~31m), and the access point (35c) located in the lowest position keeps accessing to 1 wireless

11 LAN terminal (31n).

12 **[0083]** Here, suppose the wireless LAN terminal denoted as number 31b and located in a BSS

13 (Basic Service Set) of the highest access point (35a) does not generate data traffic, and the wireless

14 LAN terminals denoted as numbers 31f, 31k, 31l and located in a BSS of the middle access point

15 (35b) do not generate data traffic.

16 **[0084]** Also, suppose the wireless LAN terminal denoted as number 31c and located in the basic

17 service set of the highest access point (35a) moves to a basic service set area of the lowest access

18 point (35c) from the highest access point (35a).

19 **[0085]** Under this circumference, the highest access point (35a) has 4 wireless LAN terminals

20 currently accessed to the self, has 3 wireless LAN terminals generating data traffic, and transmits .

21 load state information such as the number of data frames and data frame length to a management

1   system (34).

2   [0086]   In addition, the middle access point (35b) has 9 wireless LAN terminals currently accessed

3   to the self, has 3 wireless LAN terminals generating data traffic, and transmits load state information

4   such as the number of data frames and data frame length to the management system (34).

5   [0087]   The lowest access point (35c) has 1 wireless LAN terminal currently accessed to the self,

6   has 1 wireless LAN terminal generating data traffic, and transmits load state information such as the

7   number of data frames and data frame length to the management system (34).

8   [0088]   Then, the management system (34) observes a load state of the middle access point (35b).

9   If a load value of the access point (35b) located in the middle is more than a regular value because

10 the wireless LAN terminal denoted as number 31c moves or the wireless LAN terminals (31k, 31l,

11 31m) that do not continuously generate the data traffic generate the data traffic, the management

12 system (34) transmits a control signal for removing load causing factors to the middle access point

13 (35b). At this point, the management system (34) should firstly decide whether the access points

14 (35a, 35c) around the middle access point (35b) are in idle state. If in the idle state, the management

15 system (34) transmits the control signal for removing the load causing factors to the middle access

16 point (35b).

17 [0089]   Such control signal can stop the access by transmitting an authentication failure message

18 while authenticating the wireless LAN terminal denoted as number 31c moving from the highest

19 access point (35a), or by deleting network node addresses of the wireless LAN terminals denoted as

20 numbers 31k, 31l, 31m generating new data traffic from BSS tables.

21 [0090]   Meanwhile, when failing to have access to the new middle access point (35b) though an

1   access request message is transmitted, the wireless LAN terminal denoted as number 31c keeps

2   accessing to the highest access point (35a).

3   [0091]   In addition, the wireless LAN terminals denoted as numbers 31k, 311, 31m delete the

4   middle access point (35b) accessed in access point tables, and attempt access to the

5   previously-accessed lowest access point (35c) by transmitting access request messages to the access

6   point (35c).

7   [0092]   At this time, the management system (34) provides information on the highest access point

8   (35a) to the wireless LAN terminal denoted as number 31c attempting the access through the middle

9   access point (35b) whose load is more than a threshold value, and keeps accessing to the highest

10   access point (35a).

11   [0093]   Also, the management system (34) transmits information on the lowest idle access point

12   (35c) to the wireless LAN terminals denoted as numbers 31k, 311, 31m generating new traffic

13   through the middle access point (35b) having load, and attempts access to the lowest access point

14   (35c), thereby accessing the access point (35c).

15   [0094]   On this occasion, the management system can keep accessing by transmitting information

16   on the wireless LAN terminal denoted as number 31c to the highest access point (35a) in the idle

17   state, and attempting the access by transmitting information on the wireless LAN terminals denoted

18   as numbers 31k, 311, 31m generating new data traffic to the lowest access point (35c).

19   [0095]   Fig. 4 is a diagram illustrating a detailed block configuration of an access point of Fig. 3.

20   [0096]   As illustrated in Fig.4, the access point of Fig. 3 includes a wireless processor (41), a

21   wireless LAN MAC processor (42), an Ethernet processor (43), an Ethernet MAC processor (44),

1   a memory (45), and a controller (46).

2   **[0097]**   The wireless processor (41) is composed of an amplifier, an oscillator, a transceiving

3   switch, an RF/IF converter, an IF/BB converter, a base band processor, and a modem, and

4   transceives a wireless signal for a wireless LAN service. The wireless LAN MAC processor (42)

5   controls inputting/outputting of wireless LAN data through a wireless LAN MAC protocol.

6   **[0098]**   The Ethernet processor (43) directly transceives an Ethernet signal for a wired LAN

7   service, and the Ethernet MAC processor (44) controls inputting/outputting of wired LAN data

8   through an Ethernet MAC protocol.

9   **[0099]**   The memory (45) composed of an RAM (Random Access Memory) and a flash memory

10   reports operation firmware of access points, a wireless LAN operation routine displaying an

11   operation performed by the controller (46) in mechanical language type, wireless LAN operation

12   information which is data inputted/outputted through wireless LAN terminals or networks or

13   generated while driving the wireless LAN operation routine, and load state information such as the

14   number of wireless LAN terminals currently keeping accessing by receiving a call of the wireless

15   LAN operation routine, the number of wireless LAN terminals recently generating traffic, the

16   number of data frames, and data frame length to a management system, and stores a load balance

17   controlling routine for suppressing generation of new load under control of the management system.

18   The controller (46) controls a wireless LAN operation for performing overall functions of the access

19   points, and controls accessing and inputting/outputting of the memory (45).

20   **[0100]**   Hereinafter, an operation of the access point applied by the present invention will be more

21   fully described as follows in reference to Fig. 4.

1   **[0101]**   The controller (46) controls the wireless LAN operation for performing overall functions,

2   and particularly, drives the load balance controlling routine, thus the controller reads load state

3   information such as the number of the accessed wireless LAN terminals, the number of the wireless

4   LAN terminals recently generating the traffic, the number of the data frames, and the data frame

5   length stored in the memory (45), and transmits the read information to the management system

6   through the Ethernet MAC processor (44) and the Ethernet processor (43).

7   **[0102]**   Moreover, when the control signal for suppressing a further increase of load is received

8   from the management system through the Ethernet processor (43) and the Ethernet MAC processor

9   (44), the controller (46) intercepts access during an access step by transmitting an authentication

10   failure message while authenticating the wireless LAN terminals accessed through the wireless LAN

11   MAC processor (42) and the wireless processor (41).

12   **[0103]**   Also, the controller (46) receives network node addresses of wireless LAN terminals that

13   do not recently transmit data traffic among the wireless LAN terminals accessed from the memory

14   (45), and deletes the received network node addresses of the wireless LAN terminals in BSS tables.

15   Thus, the controller controls to stop the access when the wireless LAN terminals that do not generate

16   the data traffic newly generate the data traffic.

17   **[0104]**   On the other hand, the controller (46) receives information on idle access points from the

18   management system through the Ethernet processor (43) and the Ethernet MAC processor (44), and

19   can induce access-rejected wireless LAN terminals to access the neighboring idle access points by

20   transmitting the information to the access-rejected wireless LAN terminals.

21   **[0105]**   Also, when receiving information on wireless LAN terminals attempting to access other

1 access point having much load from the management system through the Ethernet processor (43) and

2 the Ethernet MAC processor (44), the controller (46) of the idle access points transmits access

3 request messages to the corresponding wireless LAN terminals and keeps accessing by attempting

4 the access.

5 [0106]　Fig. 5 is a diagram illustrating a method of controlling load balance of multi-access points

6 in a wireless LAN system in accordance with one embodiment of the present invention as a flow

7 chart.

8 [0107]　As illustrated in Fig.5, in the wireless LAN system in accordance with one embodiment

9 of the present invention, the method of controlling load balance in the multi-access points includes

10 the step of monitoring load states of many access points by a management system (S110). When

11 monitoring the load states by the management system, the management system periodically receives

12 load state information from the multi-access points and continuously monitors the received load state

13 information. If a timed changing value is more than a regular value, the management system receives

14 the load state information by requesting when necessary, and monitors the load states of the access

15 points based on the received load state information. Here, though the multi-access points report the

16 load states in response to the request of transmitting the load state information from the management

17 system, it is possible for the multi-access points to periodically transmit the load state information

18 to the management system.

19 [0108]　Next, the management system monitoring the load states of the multi-access points decides

20 the load states of each access point based on the load state information received from the

21 multi-access points, and decides whether there are access points whose load values exceed a

1   threshold value (S112).

2   **[0109]** After deciding whether there are access points whose load values exceed the threshold

3   value, if there are no access points whose load values exceed the threshold value, the management

4   system repeats from the step 'S110'. If there are access points whose load values exceed the

5   threshold value, the management system decides whether there are idle access points nearby (S114).

6   **[0110]** After deciding whether there are idle access points nearby, if there are no idle access points

7   nearby, the management system repeats from the step 'S110'. If there are idle access points nearby,

8   the management system transmits a control signal for suppressing an increase of load to the access

9   points whose load values exceed the threshold value (S116).

10   **[0111]** The access points receiving the control signal for suppressing the increase of load from the

11   management system transmit an authentication response failure message for wireless LAN terminals

12   newly attempting to access, or delete network node addresses of wireless LAN terminals generating

13   new data traffic by BSS tables among accessed wireless LAN terminals, in order to stop the access

14   to the wireless LAN terminals (S118).

15   **[0112]** Next, the management system can induce the access-attempting wireless LAN terminals

16   to attempt the access by transmitting information on neighboring access points in the idle state

17   through the access points whose load values exceed the threshold value.

18   **[0113]** Also, the management system transmits information on the wireless LAN terminals to the

19   neighboring access points in idle state in order that the idle access points around the access points

20   whose load values exceed the threshold value can attempt access to the wireless LAN terminals, and

21   enables the neighboring idle access points receiving the information on the wireless LAN terminals

1   to keep accessing by attempting the access to the wireless LAN terminals.

2   [0114]   Furthermore, though an access attempting operation between the wireless LAN terminals

3   and the idle access points described above keeps a prior access method, the operation can be used

4   in the same way when attempting access between the neighboring idle access points and the wireless

5   LAN terminals whose access is stopped by generating new traffic while the terminals do not

6   continuously generate data traffic.

7   [0115]   The present invention can be realized as computer-executable instructions in

8   computer-readable media. The computer-readable media includes all possible kinds of media in

9   which computer-readable data is stored or included or can include any type of data that can be read

10 by a computer or a processing unit. The computer-readable media include for example and not

11 limited to storing media, such as magnetic storing media (*e.g.*, ROMs, floppy disks, hard disk, and

12 the like), optical reading media (*e.g.*, CD-ROMs (compact disc-read-only memory), DVDs (digital

13 versatile discs), re-writable versions of the optical discs, and the like), hybrid magnetic optical disks,

14 organic disks, system memory (read-only memory, random access memory), non-volatile memory

15 such as flash memory or any other volatile or non-volatile memory, other semiconductor media,

16 electronic media, electromagnetic media, infrared, and other communication media such as carrier

17 waves (*e.g.*, transmission via the Internet or another computer). Communication media generally

18 embodies computer-readable instructions, data structures, program modules or other data in a

19 modulated signal such as the carrier waves or other transportable mechanism including any .

20 information delivery media. Computer-readable media such as communication media may include

21 wireless media such as radio frequency, infrared microwaves, and wired media such as a wired

1 network. Also, the computer-readable media can store and execute computer-readable codes that

2 are distributed in computers connected via a network. The computer readable medium also includes

3 cooperating or interconnected computer readable media that are in the processing system or are

4 distributed among multiple processing systems that may be local or remote to the processing system.

5 The present invention can include the computer-readable medium having stored thereon a data

6 structure including a plurality of fields containing data representing the techniques of the present

7 invention.

8 [0116] An example of a computer, but not limited to this example of the computer, that can read

9 computer readable media that includes computer-executable instructions of the present invention

10 is shown in FIG. 6. The computer 60 includes a processor 62 that controls the computer 60. The

11 processor 62 uses the system memory 64 and a computer readable memory device 66 that includes

12 certain computer readable recording media. A system bus connects the processor 62 to a network

13 interface 68, modem 72 or other interface that accommodates a connection to another computer or

14 network such as the Internet. The system bus may also include an input and output interface 70 that

15 accommodates connection to a variety of other devices.

16 [0117] It is to be understood that changes and modifications to the embodiments described above

17 will be apparent to those skilled in the art, and are contemplated. It is therefore intended that the

18 foregoing detailed description be regarded as illustrative rather than limiting, and that it be

19 understood that it is the following claims, including all equivalents, that are intended to define the

20 spirit and scope of this invention.

21 [0118] According to the present invention like above, it can prevent traffic from being

1   concentrated in a wireless LAN system using multi-access points.

2   **[0119]**   Also, according to the present invention, it prevents data traffic load from being

3   concentrated, thereby reducing overall error rates of the system.

4   **[0120]**   In addition, according to the present invention, it prevents data traffic load from being

5   concentrated, thereby satisfying quick processing requirements of wireless LAN terminals.